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equivalent of 2, sulphate of soda 4, phosphate of soda and magnesium sulphate 6. The sensory effects of mixtures of these salt solutions can be correctly calculated on the bases of these equivalents. They have thus their own smell, though they have before been considered odorless.

With the cathode in the nose the author had a distinct sensation of smell in opening an electric circuit, and with the anode in the nose by closing it. In opposition to Bidder it was also found that fragrant substances taken into the mouth and expelled through the choana were distinctly smelled, and it is inferred with Paulsen that the expiratory and inspiratory current of air take substantially the same course through the nose. Fatigue soon blunts and almost arrests the sense of smell, but it fully recovers its degree of sensitivity, but not its power of endurance, in a few minutes. Entire exhaustion from one odor leaves the organs of smell with maximal sensitiveness for other odors. Thus the law of specific energy seems to hold for various olfactory fibres or systems of fibres. This fact would seem to give a method by which the much disputed problem of a classification of smells could be solved. But it is needful that experiments be made with chemical substances of known composition. Chemists differ widely respecting the smell of some even of the more common objects, and of many others the text-books do not state whether they smell or not. Only four elements, chlorine, bromine, iodine, and phosphorus, smell. These seem to the author to be odorless in a pure state, and he concludes that all elements are odorless. There are few more vague terms in the psychology of sensation than those designating odorous qualities, and the need of a more chemically scientific nomenclature is greatly felt. Smells were located by the author and others whom he tested not in but before the nose. One of his subjects had a very vivid dream of experimenting with camphor which seemed to be very distinctly smelled. The author finally queries whether the movement of many odorous substances on the surface of water is connected with the ciliary epithelium which Waldeyer lately found over the olfactory region. It seems especially to be hoped that the capacities of the fatigue method of classifying odors will soon be more fully tested.

*Note on the Specific Energy of the Nerves of Taste.* Studies from the Biological Laboratory of the Johns Hopkins University, Vol. IV, No. I. By W. H. HOWELL, Ph. D., and J. H. KASTLE, S. B.

A chemically pure substance, named para-brom-benzoic sulphide (formula  $C_6H_5Br \left\{ \begin{matrix} CO \\ SO_2 \end{matrix} \right\} > NH$ ), first made in the chemical laboratory of this University, and a derivative of the new substitute for sugar called saccharine, was found to cause very intense and pure gustatory sensations of bitter when applied to the back part of the tongue (region of the circumvallate papillae) and a sweet taste when applied to the tip and borders of the anterior half of the tongue. The latter sensation was much feebler, sometimes reported as slightly acid or metallic sweet or slightly astringent. In a few of the twenty persons tested the sensation on the lip was at first slightly bitter, then sweet, which does not accord with the reaction time experiments of Vintschgau, which showed sweet much quicker than bitter. Saccharine itself on the back of the tongue caused in some persons a rapid alternation of the sensations of sweet and

bitter, like rivalry of the two fields of vision. That a chemically pure substance arouses different taste sensations (and those more purely gustatory than acid and salt) favors the doctrine that each taste sensation has its own specifically energized set of nerve fibres.

*Die Methode der Aequivalente angewandt zur Maassbestimmung der Feinheit des Raumsinnes.* Von Dr. W. CAMERER. Zeitschrift f. Biologie, 1886, pp. 509-559.

The chief object of this "method of aequivalents" (first used by Weber) is to ascertain the relative sensibility of different parts of the sensory surface. Dr. Camerer contributes a very extensive though somewhat unsatisfactory series of observations on the "space sense" of the skin as tested by this method. For example, he places the compass points 4 lines apart (1 line = 2.256 mm.) on the forehead, and then finds how far apart the points of a second compass must be to produce a sensation of equal aperture on the lips, and finds it 2.4 lines, *i. e.* the "aequalization ratio" of the forehead to the lips is  $\frac{4}{2.4} = 1.67$ .

The application of the line is always closely successive, and the variations caused by beginning with an aperture too wide and gradually narrowing, or reversing this proceeding; by applying the "constant" compass first or last; by varying the absolute distance between the compass points, are all worked out in detail. It is also evident that a constant as well as a variable error will come into play. The following table summarizes the results of the first portion of his experiments:

Constant Distances.	1st Series. Forehead to Lip.	2d Series. Forehead to Wrist.	4th Series. Palm to Forehead.	5th Series. Palm to Forehead.	Mean of 4th and 5th Series.	Constant Distances.	3d Series. Forehead to Finger Tip.
4 Lines.	1.668	1.0165	0.972	—	—	0.5	1.051
8 "	1.353	0.9763	1.043	0.982	1.012	1.0	1.055
12 "			1.048	0.996	1.022	1.5	1.044
16 "			1.037	0.989	1.013	2.0	1.033
20 "			1.016	0.985	1.000	2.5	1.028
24 "			1.032	1.003	1.017	3.0	1.025

Each ratio is based upon 240 observations, and the distances were always applied transversely. An important result is that the ratio is affected by the absolute size of the distance applied, the ratio approaching unity as the distance increases.

Many irregularities occur; while in the 4th series the forehead has a finer sensibility than the palm, in the fifth series this is reversed. It is also to be noticed that this method does not show nearly as great differences between the severable parts of the skin as Weber does with the method of "just observable differences."

The individual differences of the four observers who were tested were slight; the effect of practice was quite marked, as shown by a decrease of the aequalization ratio; and the average deviation (variable error) was about 8.5 per cent (in Series 1), it being considerably smaller in the larger distances than in the shorter ones.

A few other questions that were asked were these: